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Army Service Forces  
Quartermaster Corps  
CLIMATIC RESEARCH LABORATORY  
Lawrence, Massachusetts

INITIAL CLASSIFICATION CHANGED  
TO UNCLASSIFIED  
Letter DMRDW-I  
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Monthly Report - 1 November 1944

SECURITY FILTER

1. The following numbered reports were submitted to the Office of The Quartermaster General for the approval of Brig. General Georges F. Doriot:

Report Nos. 182, 185, 193, 203 - 10 October 1945

Sleeping Bags and Sleeping-Bag Pads

Measurement of Thermal Insulation by Physical Procedures

Ten Tables and Twenty-Four Figures

This report is a summary of the physical procedures used in the evaluation of thermal insulation of sleeping gear. Included are sleeping bags, sleeping-bag pads and types of fill for sleeping bags. The various electro-physical devices employed in this study are described only briefly since a supplementary report will be devoted exclusively to this subject.

The study was divided into three phases; (1) Investigation of various substitute fills for the Bag, Sleeping, Mountain, taking into account the effect of a substitution upon the thermal insulation values of the top (uncompressed) and bottom (compressed) sections of the bag, (2) Determination of the thermal insulation value of experimental fabrics for Bag, Sleeping, Wool, and comparison with the fabric in current use, (3) Exploration and development of effective types of sleeping-bag pads for provision of under-protection against cold and moisture as well as that of ease and convenience of carrying.

It was concluded that the mean clo value of the undersection of Bag, Sleeping, Mountain is inadequate, irrespective of the composition and quantity of fill. In spite of the fact that some fills have a higher clo value than others, the difference possesses little practical significance because of the extremely low insulation value of all fills when compressed. Although the increase in weight of fill per square yard increases the insulation value, this improvement is impractical because of the excessive additional weight and bulk necessary before the insulation provided is raised to the required value; i.e., approximately 6 clo, as in the uncompressed portion of the bag. A considerable dilution of the down-waterfowl feather mixture is permissible before the thermal insulation value of the top section decreases appreciably.

Type 11E experimental fabric for Bag, Sleeping, Wool is superior in thermal insulation to any of the other fabrics measured but not sufficiently so, however, to warrant its use in place of the standard fabric on the basis of thermal insulation measurements and requirements of protection against cold.

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No one sleeping-bag pad is entirely satisfactory in all of the characteristics tested which are considered essential to an acceptable item. Present indications are that a satisfactory inflatable pad is feasible, weighing less than 1 pound, having a small packing volume, adequate performance at subfreezing temperatures, adequate surface area and insulation (more than 4 clo) and either unfilled or having a fill of proper density.

Report No. 180-A - 10 October 1945

Thermistor Electronic Thermoregulator

An Instrument for Precision Automatic Temperature Control

One Table - Fourteen Figures

The instrument described in this report was designed for the purpose of automatically maintaining the surface temperature of the thermal transmission apparatus in use at this laboratory at any desired level within the physiological range of human skin temperatures. In the preliminary physical experimentation on the thermal insulation of textiles and clothing, manual control and modifications of the Leeds Northrup Micromax temperature recorder were used with moderate success, but it became increasingly evident that precise automatic control was necessary to handle a constantly enlarging research and testing program. The possibility of using Thermistors, a new electrical semi-conductor which possesses a temperature coefficient of resistance much higher than any other conventional type of temperature-sensitive resistor, was investigated. After conferences with representatives of Bell Telephone Laboratories and initial experiments at this laboratory, it seemed feasible to design a Thermistor as well as an electronic temperature regulating circuit to meet the particular requirements of this laboratory. The details of the Thermistor design are discussed in another report. In this report the electronic circuit development is described. The circuit finally used has several of the features of the earlier ones of Hall, Benedict, Sturtevant, Bancroft and Coates. It consists of an a.c. Wheatstone bridge, one arm of which contains the Thermistor, a two-stage resistance-capacitance coupled amplifier, and a thyratron-operated relay which opens or closes the heater circuit being controlled. Its advantages are simplicity of electrical design and mechanical construction, combined with high temperature sensitivity and versatility. Its range is from 30°F. to 140°F.; it responds to a temperature change of about 1/50°F., is capable of controlling a heater circuit carrying up to 20 amperes of 115 volts a.c., operates a 115-volt 60-cycle timer, and has a built-in 115-volt 60-cycle power supply.

Report No. 4565 - 18 October 1945

Auxiliary Heating for Handwear

Utility and Efficiency of American, British and German Hand Warmers  
Nine Tables and Seven Figures

It is generally appreciated that the best functional handgear available does not provide adequate protection at ambient temperatures below 0°F. Since protection to the extremities is particularly important for soldiers fighting and living in cold weather, it would be most desirable to supply an auxiliary heating device for warming the hands. In order to be a

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satisfactory device it must produce heat quickly and efficiently without being too cumbersome and complex to be carried in combat. At present, some hand warmers which appear to satisfy such military requirements are available. They may be classified into (a) fuel-type, and (b) water-type, both of which are so designed that they are of convenient size and weight and are easily operated. Certain models are sufficiently durable for field use. Their heat production, however, varies to such a degree that extensive testing is required for the determination of efficiency. In order to obtain these determinations, and in an effort to develop an improved hand warmer, a comprehensive series of experiments have been performed.

The following items were included for test:

a. Fuel-Type Hand Warmers

- (1) Warmer, Hand, Abercrombie-Fitch
- (2) Warmer, Hand, So-Lo

b. Water-Type Hand Warmers

- (1) Warmer, Hand, Kemi-Therm
- (2) Warmer, Hand, German
- (3) Warmer, Hand, British

It was concluded that neither of the fuel-type hand warmers were satisfactory for field use. The water-type items, on the other hand, were satisfactory at temperatures as low as minus 40°F. Further development in both types was recommended.

Report No. R-242 - 22 October 1945

Radiometer

Improved Microradiometers for the Measurement of the Surface Temperatures of Human Skin

Twenty Figures

Radiometers for skin-temperature measurements have been devised to meet the requirements of the research program of this laboratory. A microradiometer of suitable dimensions has been constructed and utilized to measure skin temperature under the clothing of subjects exposed to ambient temperatures of between plus 75°F. and minus 50°F. Microradiometric measurements were compared with results obtained from the type thermocouple harnesses used in physiological testing and research at this laboratory. The error in absolute temperature inherent in the latter method amounts to as much as several degrees and its direction appears to depend upon the rate of cooling of the skin. Further work on decreasing the dimensions of the microradiometer for skin-temperature measurements on the fingers is in progress.

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Report No. 186-A - 25 October 1945

Anemometer

An Improved Hot-Wire Anemometer for the Measurement of Wind Velocity  
Three Figures

A hot-wire anemometer for the measurement of wind velocity in thermal transmission experiments on textiles and clothing has been designed. The instrument is portable and a relatively small wind-sensitive element incorporated in it. Air velocity is indicated by the deflection of a milliammeter which may be located and read at a distance from the sensitive element. By use of calibrated wind screens, the useful range of the instrument is between 1 and 23 miles per hour, with a conservatively rated accuracy of 5-10 percent in non-turbulent air streams. The circuit consists of a d-c Wheatstone bridge, two arms of which are made of temperature-sensitive wire. The circuit constants are so selected that one of the arms is self-heated by the bridge current and is therefore wind-sensitive; the other arm is virtually at ambient air temperature and insensitive to wind. With this arrangement, the circuit is unresponsive to changes in ambient air temperature. The only disadvantage of the instrument is its rapidity of response to changes in air movement which makes measurements in turbulent air difficult.

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